Stage-wise Training Strategy for Multiple Mental Disorder Detection

FOCUSED KAN IN TRANSFORMERS

Team 5

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Introduction

- 23.1% of U.S. adults experienced AMI in 2022
- 3% having more than one mental illness concurrently.

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Mental disorders significantly affect daily life but are hard to detect due to subjective and nuanced symptoms. Social media data, with spontaneous expressions of emotions and symptoms, mitigate biases from face to face interactions.

Challenges of training a multi-task model:

- **Limited Multi-labeled Datasets**
- **Unique linguistic & contextual features of each disorder**
- **Biases in Different Task Difficulties**

We propose: Stage-wise Training Strategy using Transformer with Kan

Dataset(StageTraining) *From Reddit Pushshift Dump (2005-2023)*

Case Subreddit

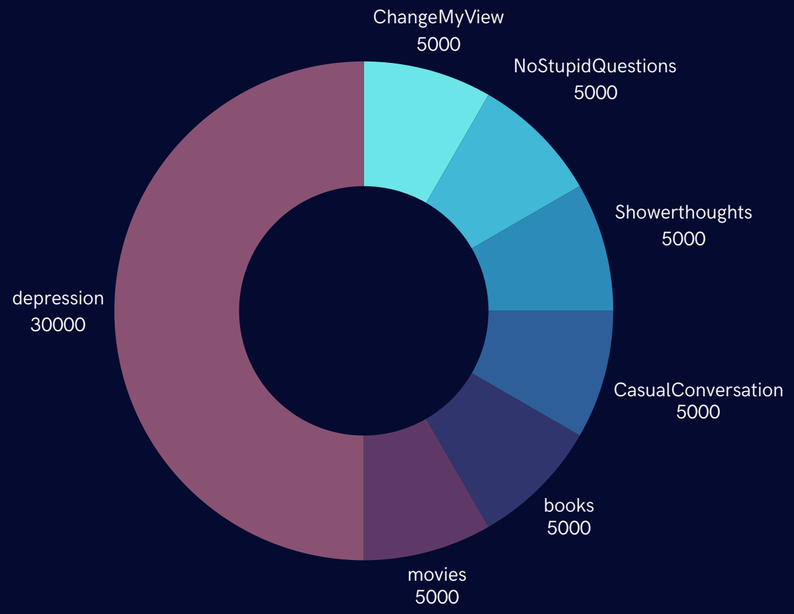
- **r/depression**
- **r/Anxiety**
- **r/OCD**
- **r/bipolar**
- **r/ptsd**

Control Subreddit

- r/ChangeMyView
- r/NoStupidQuestions
- r/Showerthoughts
- r/books
- r/movies
- r/*CasualConversation*

Data Preprocessiong

posts marked as null or empty (e.g., posts labeled as "[removed]" or "[deleted]" or those containing only URLs) were removed, etc.



After preprocessing, a subset of:

- Case: **30,000** usable posts
- Control: **25,000** usable posts

Was selected for analysis

Split 80-20 for training and testing

Train on Each Data Sequentially

Dataset (Finetuning)

From Kaggle and Chat-GPT

a Kaggle dataset:
Includes texts tagged with statuses:

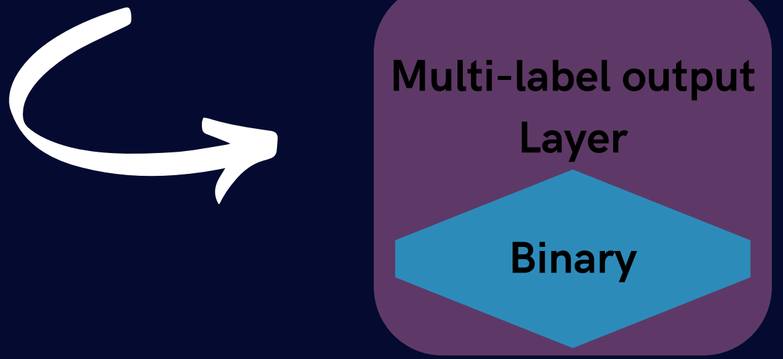
“Normal”,
“Depression”,
“Suicidal”,
“Anxiety”,
“Stress”,
“Bi-Polar”,
“Personality Disorder”.

Data Annotation

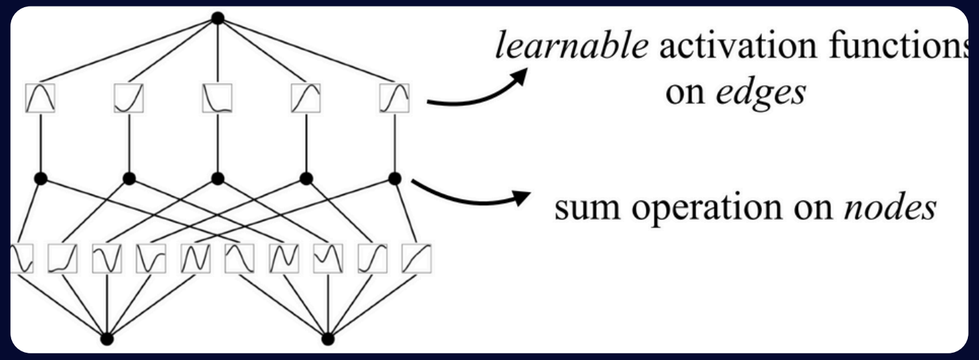
Map to our 5 target conditions using GPT 4o

This dataset contains: 53,044 posts, with **7.42% annotated with two or more condition labels**

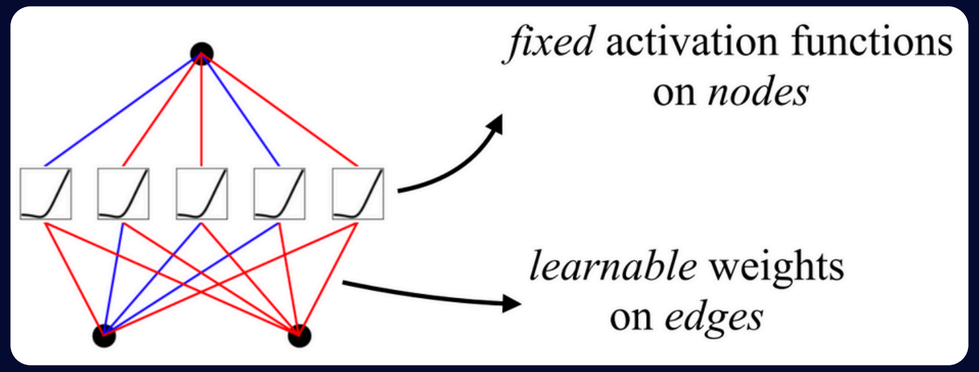
Text	Depression	Anxciety	bipolar	OCD	PTSD
...	1	0	0	0	1
...	0	0	0	1	0
...	1	1	1	0	0
(Normal)	0	0	0	0	0



Method



Kolmogorov-Arnold Network



Multi-Layer Perceptron

KAN:

more flexible

spline-parametrized univariate functions;

dynamically adapt activation patterns.

Multi-Stage Training Strategy

Method (2)

Multi-stage training strategy

1. **mental disorder datasets - binary classification tasks**

enter a new stage when the model is optimized on current data

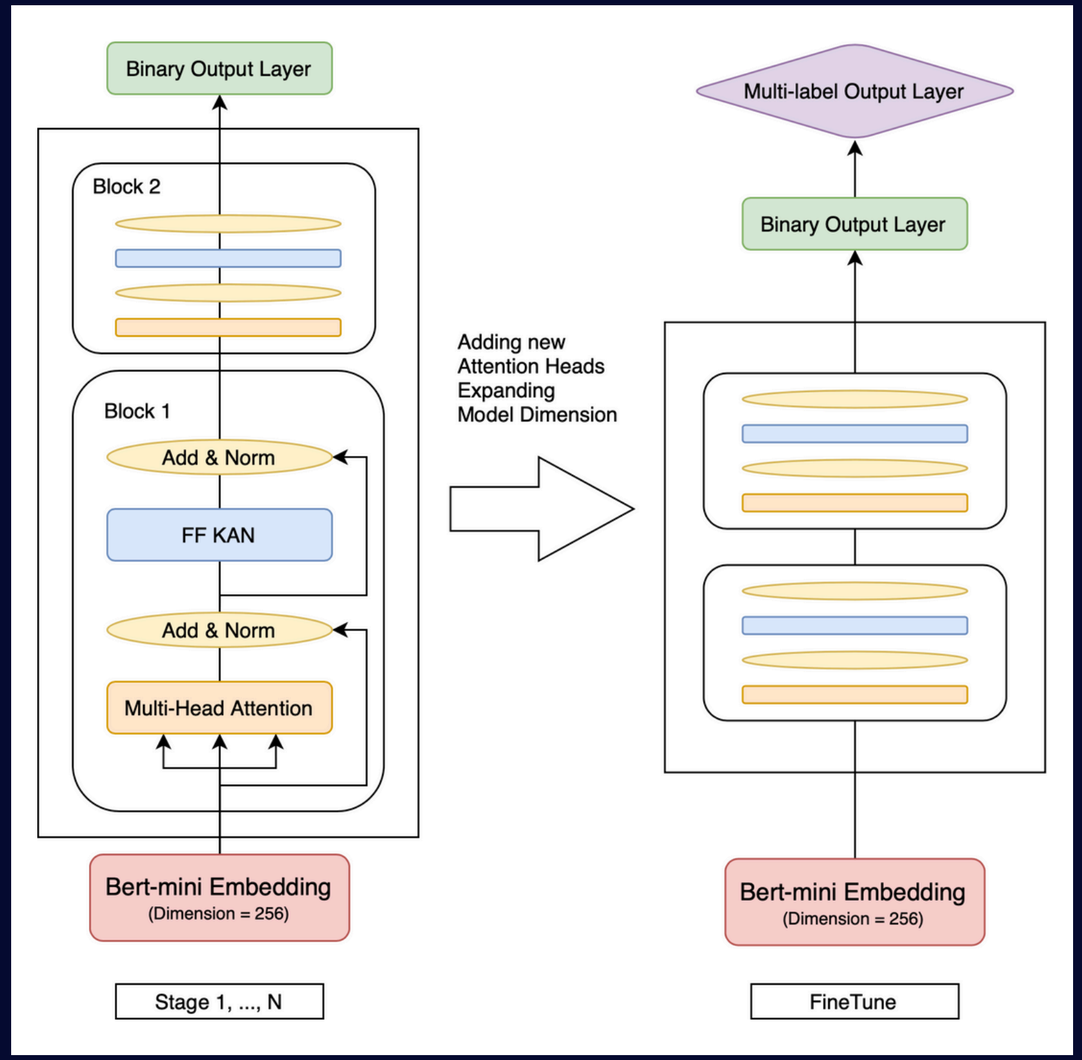
2. **FREEZE：freeze an attention head once weight changes fall below a threshold during the training process**

3. **Add new heads: ensure the model has enough capacity to learn new information**

Fine-tuning on multi-label mixed Dataset

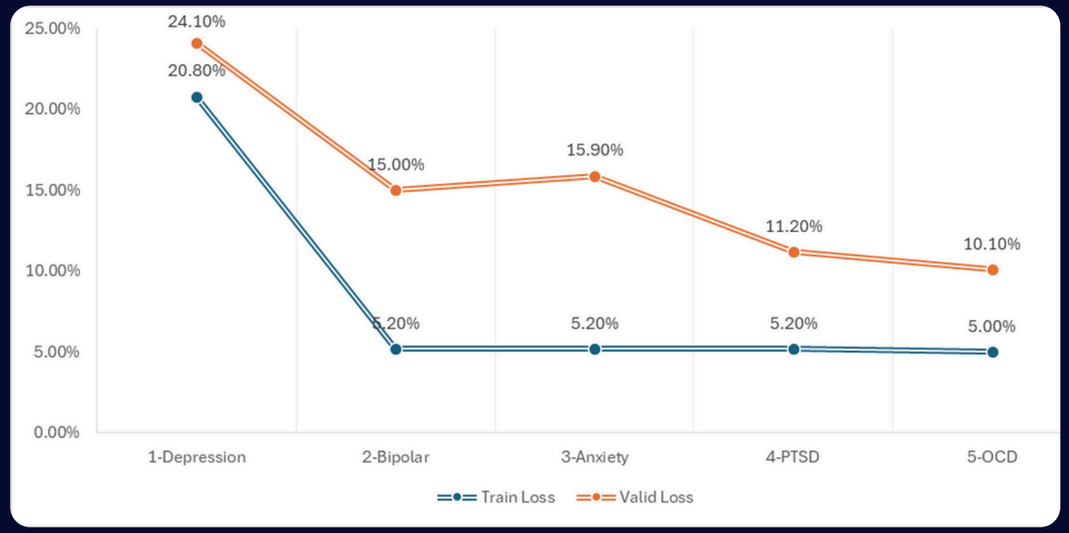
to adjust the model for the new multi-label task

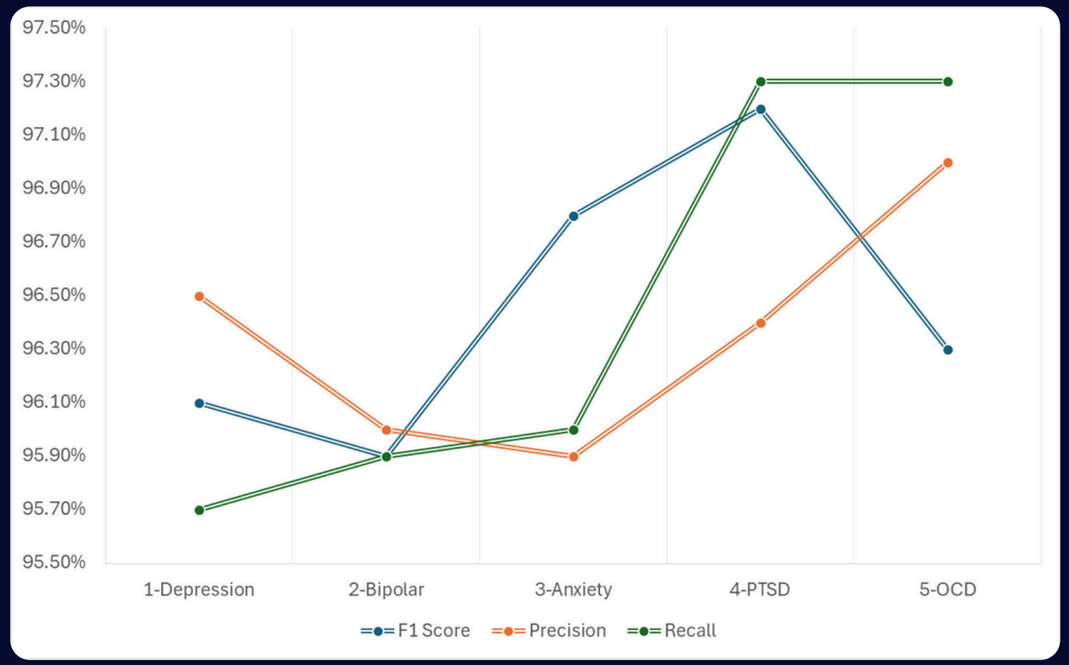
to modify the new output layer



Stage-wise Results

Stage	Train Loss	Validation loss	Recall	Precision	F1
1-Depression	0.208	0.241	0.957	0.965	0.961
2-Bipolar	0.052	0.15	0.959	0.96	0.959
3-Anxiety	0.052	0.159	0.959	0.96	0.968
4-PTSD	0.052	0.112	0.973	0.964	0.972
5-OCD	0.05	0.101	0.973	0.97	0.963

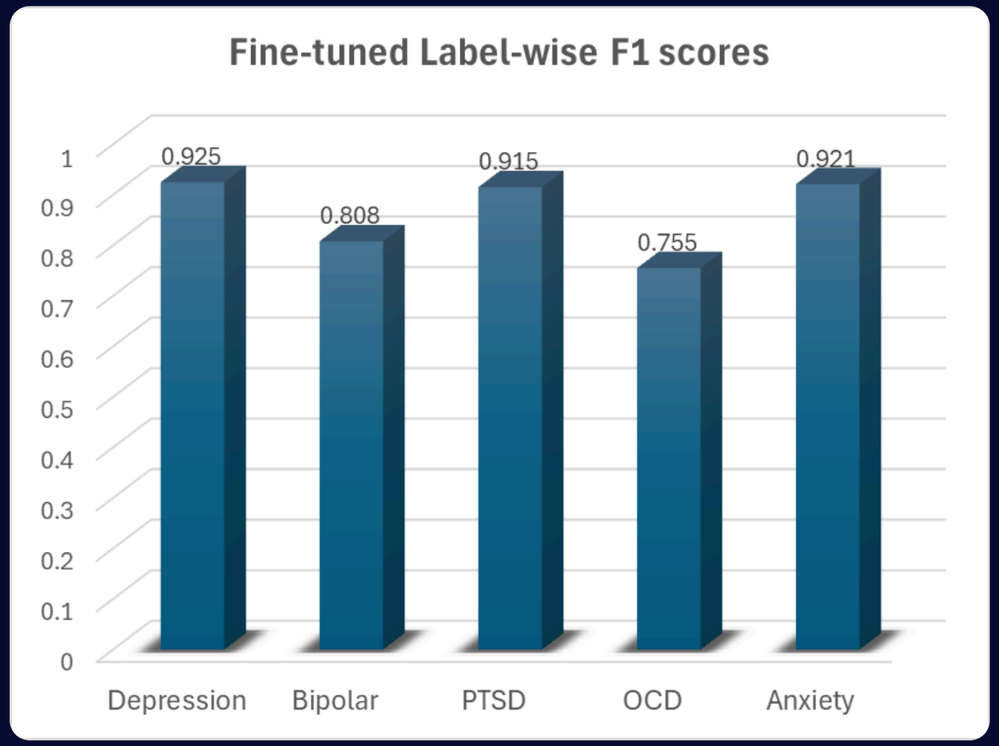




Fine-tuned Results

Label-wise F1 scores	
Depression	0.925
Bipolar	0.867
PTSD	0.915
OCD	0.834
Anxiety	0.933

Overall Model Performance		
Macro F1	**Micro F1**	**EM**
0.865	0.915	0.891



“Some days I feel like I'm invincible, bursting with energy and confidence, but other days, I'm drowning in my thoughts, haunted by memories I can't escape, and overwhelmed by sadness so deep it feels like I'll never climb out.” (depression + anxiety)

Depression	Bipolar	PTSD	OCD	Anxiety
0.6262	0.0007	0.0009	0.0007	0.3714

Takeaways

Model Strategies

- KAN-based Transformers
- Stage-Wise Training
- Dynamic Attention Head Freezing
- Transfer Knowledge
- Guided Training
- Continuous Learning

Model Strengths:

- Interpretability
- Task Interference
- Modular Learning
- Catastrophic Forgetting
- Shared Feature Integration
- Parameter Efficiency
- Strong Performance
- Scalability

Solving Comborbidity!